PACKAGING CONTAINER WITH INTEGRATED SHEET FOR RETENTION OF PACKAGED ARTICLE

FIELD OF THE INVENTION

The present invention relates packaging containers or boxes, particularly containers incorporating a sheet for retention of a packaged article within the container.

BACKGROUND OF THE INVENTION

Protective packaging structures are often used when an article to be transported requires protection from physical shock, dust, dirt and other contaminants. For example, when shipping articles that may be relatively fragile, it is often desirable to package the article inside a box to protect the article from physical impacts to the box that may occur during loading, transit and unloading. In addition, when shipping sensitive electronic articles, such as computer components, it is often desirable to protect those components from dust and dirt. Aside from the shipping box itself, some additional packing materials are often needed to prevent the article from being damaged by uncontrolled movement within the box. Such additional packing material may comprise, for example, paper or plastic dunnage, molded plastic foam, foam-filled cushions, and the like.

One useful form of packaging for especially fragile articles is referred to as suspension packaging, examples of which are disclosed in U.S. Pat. No. 4,852,743 to Louis H. Ridgeway and U.S. Pat. No. 5,388,701 to Devin C. Ridgeway. In suspension packaging, the article is suspended between two sheets of plastic film. The sheets are usually attached to frames that are sized to fit securely within a selected size box. The fact that the article is not in contact with any substantially rigid surfaces protects it from physical shock. It is not necessary in all cases, however, for the article to be entirely suspended within the box, such as when packaging less fragile articles. In such cases, the extra space required for full suspension packaging becomes a less efficient use of such materials.

An alternative to suspension packaging is referred to as retention packaging, examples of which are disclosed in U.S. Pat. No. 5,678,695 to Devin C. Ridgeway et al. In retention packaging, an article is positioned between a sheet of flexible film and a rigid backing. The film is connected to folding side portions of the rigid backing such that the film is tightened against the article as the rigid side portions are folded away from the film. The folded structure fits within a selected box size that holds the article securely in place, but in contact on one side with a rigid surface. While retention packaging reduces the overall size of the packaging, placing the article between the flexible film and rigid backing is a cumbersome process and may increase the overall time needed to package each article. When packaging many thousands of articles, this incremental increase in time may have a substantial overall impact on shipping costs.

There remains a need in the art for packaging structures that are easier and less time-consuming to use than prior art packaging structures. Preferably, such structures will make efficient use of materials so as to be able to package articles in smaller containers than previously possible without sacrificing the strength of the packaging structure.

SUMMARY OF THE INVENTION

In one aspect, the present invention provides a packaging container for an article, the container comprising a box adjustable between an open configuration and a closed configuration. The box comprise a plurality of side panels and a bottom panel or surface arranged to define a storage compartment that is accessible through an opening when the box is in the open configuration. A first flap and a second flap form a first pair of opposing flaps, each of the first and second flaps being attached to corresponding side panels of the plurality of side panels and adapted for folding across at least a portion of the opening when the box is in the closed configuration. In one embodiment, the box also includes a second pair of opposing flaps that are also attached to a corresponding side panel of the plurality of side panels and adapted for folding across at least a portion of the opening when the box is in closed configuration. The box further comprises a sheet having a first end affixed to the first flap and a second end affixed to the second flap. When the box is in the closed configuration, a first portion of the sheet is within the

storage compartment, a second portion of the sheet is between the first flap and at least one of the second pair of opposing flaps, and a third portion of the sheet is between the second flap and at least one of the second pair of opposing flaps.

In another embodiment, the packaging container of the invention comprises a box that comprises a plurality of side panels, a bottom, and a first pair of opposing flaps as described above, and additionally includes a third flap attached to a corresponding side panel of the plurality of side panels and adapted for folding across at least a portion of the opening when the box is in the closed configuration. In this embodiment, when the box is in the closed configuration, a first portion of a sheet, which has a first end affixed to the first flap and a second end attached to the second flap, is within the storage compartment. A second portion of the sheet is between the first flap and the third flap and a third portion of the sheet is between the second flap and the third flap.

In a further aspect, the present invention provides a packaged article comprising a packaging container as described above, wherein the box is in the closed configuration, and an article within the storage compartment and retained between the first portion of the sheet and each of the first and second pairs of flaps.

In yet another aspect, the invention provides a method of packaging an article, the method comprising providing a packaging container as described above, positioning the box in the open configuration, placing an article to be packaged on the sheet, folding the second pair of flaps across at least a portion of the opening, and subsequently folding the first pair of opposing flaps across at least a portion of the opening and over the second pair of flaps to place the box in the closed configuration and to retain the article between the first portion of the sheet material and at least one flap selected from the first and second pairs of flaps.

BRIEF DESCRIPTION OF THE DRAWINGS

Having thus described the invention in general terms, reference will now be made to the accompanying drawing, which is not necessarily drawn to scale and wherein:

FIG. 1 is a perspective view of a packaging container according to the invention prior to placement of the article within the container;

FIG. 2 is a perspective view of a packaging container according to the invention after placement of an article on the sheet;

FIG. 3 is a perspective view of a packaging container according to the invention following closure and sealing of the container;

FIG. 4 is a cross-sectional side view of a packaging container according to the invention prior to placement of an article within the container;

FIG. 5 is a cross-sectional side view of a packaging container according to the invention after placement of the article within the container;

FIG. 6 is a cross-sectional side view of a packaging container according to the invention following closure and sealing of the container;

FIG. 7 is a perspective view of an alternate embodiment of the packaging container according to the invention comprising more than one sheet; and

FIG. 8 is a cross-sectional side view of a packaging container according to the invention that includes a cushioning insert.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention now will be described more fully hereinafter. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout. As used in this specification, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. The term “comprising” and variations thereof as used herein is used synonymously with the term “including” and variations thereof and is an open, non-limiting term.

Multiple embodiments of the packaging container of the present invention are described herein. The packaging container comprises a box and a sheet. The box comprises a plurality of side panels and a bottom (i.e.; bottom panel or surface) arranged to define a storage compartment, and at least one pair of opposing flaps adapted for folding across at least a portion of the opening of the storage compartment. The sheet is affixed to one or more of the closure flaps.

The side walls, bottom and flaps of the box may be formed from any substantially rigid, lightweight, foldable material, such as cardboard, plastic, compressed foam, paperboard, corrugated cardboard and the like. A useful material is a single wall corrugated cardboard such as B-flute or C-flute corrugated cardboard. In accordance with techniques which are generally known in the packaging art, a single panel or blank of such material may be folded according to predetermined patterns to yield containers having a desired size and structural features for a particular application. The packaging container may comprise an RSC-type container known in the art. The box may comprise a polyhedron-shaped storage compartment, meaning the side panels, bottom and closure flaps are polygon-shaped (e.g., rectangular).

The sheet may be flexible and resilient, for example, so that the sheet can cradle or support a packaged article without damaging the sheet or the packaged article. The sheet may have any total thickness as long as it provides the desired properties (e.g., flexibility, elasticity, optics, strength) for the given packaging application of expected use. The sheet may have a thickness of less than about any of the following: 10 mils, 6 mils, 5 mils, 4 mils, 3 mils, 2 mils, 1.5 mils, and 1 mil. (A "mil" is equal to 0.001 inch.) The sheet may also have a thickness of at least about any of the following: 0.5 mils, 1 mil, 1.5 mils, 2 mils, and 3 mils.

The sheet may have an elastic recovery in either or both of the transverse and longitudinal directions of at least about any of the following values: 60%, 65%, 70%, 75%, 80%, and 85%, measured according to ASTM D5459-95 at 100% strain, 30 seconds relaxation time, and 60 second recovery time.

The sheet may have a maximum load tear resistance in either or both of the transverse and longitudinal directions of at least about any of the following values: 400, 450, 500, 550, and 600 grams force, measured according to ASTM D1004-94a.

The sheet may have a slow puncture maximum load of at least about any of the following values: 4, 4.5, 5, 5.5, 6, 6.5, and 7 pounds force, measured according to ASTM F1306-90 using a crosshead speed of 5 inches per minute.

The sheet may have a Young's modulus sufficient to withstand the expected handling and use conditions, yet provide a "soft" feel that may be desirable for a packaging application. The sheet may have a Young's modulus of at least about any of

the following values: 2,000; 2,500; 3,000; 3,500; and 4,000 pounds/square inch. The sheet may have a Young's modulus of no more than about any of the following values: 8,000; 10,000; 15,000; 20,000; 30,000; and 40,000 pounds/square inch. The Young's modulus is measured in accordance with ASTM D882, measured at a temperature of 73°F.

The sheet may be transparent so that the packaged article may be visible through the sheet. "Transparent" as used herein means that the material transmits incident light with negligible scattering and little absorption, enabling objects to be seen clearly through the material under typical unaided viewing conditions (i.e., the expected use conditions of the material). The transparency (i.e., clarity) of the sheet may be at least about any of the following values: 65%, 70%, 75%, 80%, 85%, and 90%, measured in accordance with ASTM D1746.

The sheet may have a heat-shrink attribute. For example, the sheet may have any of a free shrink in at least one direction (i.e., machine or transverse directions), in each of at least two directions (i.e., machine and transverse directions), or a total free shrink measured at any of 160°F and 180°F of at least about any of the following: 7%, 10%, 15%, 20%, 25%, 30%, 40%, 50%, 55%, 60%, and 65%. Alternatively, the sheet may be non-heat shrinkable (i.e., has a total free shrink of less than 5% measured at 160°F).

As is known in the art, the total free shrink is determined by summing the percent free shrink in the machine (longitudinal) direction with the percentage of free shrink in the transverse direction. For example, a sheet that exhibits 50% free shrink in the transverse direction and 40% free shrink in the machine direction has a total free shrink of 90%. Although preferred, it is not required that the sheet have shrinkage in both directions. Unless otherwise indicated, each reference to free shrink in this application means a free shrink determined by measuring the percent dimensional change in a 10 cm x 10 cm specimen when subjected to selected heat (i.e., at a certain temperature exposure) according to ASTM D 2732.

The sheet may comprise, for example, one or more fabrics. Useful fabrics include wovens, knits, nonwovens, and openwork meshes (e.g., netting). Exemplary fabrics also include various types of spandex, including Lycra® brand spandex, and elastic fabrics.

The sheet may comprise one or more polymers. Exemplary polymers include thermoplastic polymers, polyethylene homopolymers (e.g., low density polyethylene), polyethylene copolymers (e.g., ethylene/alpha-olefin copolymers ("EAOs"), ethylene/unsaturated ester copolymers, and ethylene/(meth)acrylic acid), polypropylene homopolymers, polypropylene copolymers, polyvinyl chloride, various types of natural or synthetic rubber (e.g., styrene-butadiene rubber, polybutadiene, neoprene rubber, polyisoprene rubber, ethylene-propylene diene monomer (EPDM) rubber, polysiloxane, nitrile rubber, and butyl rubber), polyurethane, and other polyolefins. The sheet may also comprise thermoplastic polyolefin elastomers (TPOs), which are two-component elastomer systems comprising an elastomer (such as EPDM) finely dispersed in a thermoplastic polyolefin (such as polypropylene or polyethylene). "Copolymer" as used in this application means a polymer derived from two or more types of monomers, and includes terpolymers, etc.

Exemplary EAOs include one or more of the following: 1) medium density polyethylene ("MDPE"), for example having a density of from 0.93 to 0.94 g/cm3; 2) linear medium density polyethylene ("LMDPE"), for example having a density of from 0.926 to 0.94 g/cm3; 3) linear low density polyethylene ("LLDPE"), for example having a density of from 0.915 to 0.930 g/cm3; 4) very-low or ultra-low density polyethylene ("VLDPE" and "ULDPE"), for example having density below 0.915 g/cm3, and 5) homogeneous EAOs.

The sheet may be manufactured by thermoplastic film-forming processes known in the art (e.g., tubular or blown-film extrusion, coextrusion, extrusion coating, flat or cast film extrusion). A combination of these processes may also be employed.

At least one side of the sheet may be corona and/or plasma treated to change the surface energy of the film, for example, to increase the ability of the sheet to adhere to a flap.

The sheet may comprise effective amounts of one or more of tackifiers, antiblocking agents, and slip agents – or may be essentially free of any of these components. Tackifiers, antiblocking agents, and slip agents, and their effective amounts, are known to those of ordinary skill in the art.

A sheet comprising polyvinyl chloride may be useful for lightweight applications, for example, where a thickness of only 2-4 mils may be desirable. A sheet comprising polyurethane (e.g., SP876, a commercially available product of the BASF Company) may be useful for packaging a large article or an article having sharp protrusions. A sheet comprising polyurethane may provide desirable elastomeric, puncture resistance, temperature resistance, and tackiness characteristics.

Useful sheets (i.e., films) are described in copending U.S. Patent Application Serial No. 10/147,704 filed May 16, 2002 entitled "Packaging Structure Having a Frame and Film," which is incorporated herein in its entirety by reference.

The invention will now be described with reference to the figures, wherein an RSC-type embodiment of the box of the invention is shown. Typically, a box of the type shown in FIG. 1 is constructed of a single piece of material, such as a single piece of corrugated cardboard, and simply folded to form the desired container shape.

The box is adjustable between an open configuration, as shown in Figures 1-2, 4-5, and 7, and a closed configuration, as shown in Figures 3, 6, and 8.

Referring to FIG. 1 and corresponding cross-sectional view in FIG. 4, the packaging container **10** includes a box **15** comprising side panels **18** and a bottom **16** (i.e., bottom surface or panel) to define storage compartment **14**. The bottom **16** may be formed from a single panel as illustrated or may be formed by closing two pairs of opposing foldable flaps (not shown). The storage compartment **14** is accessible through an opening **17** through which an article **22** may enter the storage compartment. The box **15** may be closed by covering the opening **17** of the storage compartment **14** with one or more of flaps **27, 29, 31,** and **33**. Flaps **27** and **29** form a first pair of opposing flaps **26**. Each of flaps **27** and **29** are attached (e.g., foldably or hingedly attached) to a corresponding side panel **18**. As shown, flaps **27** and **29** are "major" flaps, since they extend along the longer of the side panels **18**. Flaps **31** and **33** form a second pair of opposing flaps **28**. Each of flaps **31** and **33** are attached to a corresponding side panel **18**. As shown, flaps **31** and **33** are "minor" flaps, since they extend along the shorter side walls **18**.

The first pair of flaps **26** and the second pair of flaps **28** are each adapted for folding across at least a portion of the opening **17** of the storage compartment **14** to place

the box in the closed configuration. Each of the flaps is attached to its corresponding side panel **18**. As shown in FIG. 1, the minor flap pair **28** may be dimensioned so as to extend across only a portion of the opening of the storage compartment **14**, while the major flap pair **26** may be dimensioned to cover substantially the entirety of the opening of the storage compartment. The major flap pair **26** and the minor flap pair **28** can be arranged in a perpendicular configuration, meaning the major flaps and their associated side panels **18** are roughly perpendicular to the minor flaps and their associated side panels (i.e., the container is rectangular).

A sheet **20** extends across the opening **17** of the storage compartment **14**. The first end **40** of sheet **20** is attached or affixed to flap **27**. The second end **42** is affixed to flap **29**. The sheet **20** may be affixed to the flaps using any means of affixation known in the art, such as staples, tape, glue, pressure sensitive adhesives, or other adhesives known in the art.

Although not shown in the drawings, the sheet may alternatively or additionally be attached to the minor flap pair **28**. However, by only attaching the sheet **20** to the major flaps **26**, when using an RSC-type container designed to be collapsed and palletized prior to use, the sheet **20** may be less likely to inhibit the collapse of the container into a substantially flat configuration that is easily palletized.

The sheet **20** can be adhered to the flaps at any location on the flaps between the point of attachment of the flaps to the side panel **18** and the outer edge of the flaps distal to the panels **18**. The sheet may be affixed to the flap proximate to the outer edge of the flap distal to the point of attachment of the flap to the side panel **18**. By affixing the sheet **20** proximate to the outer edge of the major flaps **26**, greater stretching of the film may occur when the box is placed in the closed configuration.

To provide greater flexibility to the end user of the container, packaging container can be provided to the user with only the first end **40** of the sheet **20** attached to flap **27**, while the other end **42** may be attached by the end user at the desired location along flap **29**. To facilitate attachment by the end user, the end **42** of the sheet **20** may carry a layer of adhesive, such as a pressure sensitive adhesive (not shown), or be otherwise adapted for affixation to the flap **29**. The end user can determine a desirable position for affixing the second end **42** of the sheet **20** to the flap **29** based on the physical characteristics (e.g.,

size, weight, etc.) of the article **22** to be packaged. The sheet **20**, which is of sufficient size to span the opening **17** of the storage compartment **14**, can thus be adjusted to the desired level of tautness prior to use. The level of tautness in the sheet **20** will determine the amount of stretching or deformation that the sheet may undergo upon placing the box in the closed configuration to package the article **22**.

As shown in FIG. 1, a single sheet **20** can extend across substantially the entirety of the opening **17** of the storage compartment **14.** Alternatively, multiple sheets can extend across the opening the storage compartment. In the embodiment shown in FIG. 7, the first sheet **20** does not cover the entirety of the opening **17**. Instead, a second sheet **21** is also attached to the flaps **27** and **29**.

FIG. 2, and the corresponding cross-sectional side view in FIG. 5, illustrate initial placement of an article **22** in the packaging container **10** of the invention. As shown, placement of the article **22** on the sheet **20** results in downward deflection of the sheet such that a first portion **50** of the sheet is within the storage compartment **14**. This also results in raising of the major flaps **26** from a substantially horizontal position to a more vertical orientation. After placement of the article **22** upon the sheet **20**, the minor flaps **28** may be folded across at least a portion of the opening **17** to contact the article **22**. Closure of the minor flaps **28** may result in greater downward deflection of the stretchable film **20** as the article **22** is pushed further into the storage compartment **14**. As shown in FIG. 6, once the minor flaps **28** are closed, the major flaps **26** may be closed such that a second portion **52** of the sheet is between flap **27** and the second pair of flaps **31** and **33**, and a third portion **54** of the sheet is between flap **29** and the second pair of flaps **31** and **33**. As shown, the major flaps overlay the minor flaps and extend substantially across the entirety of the opening of the storage compartment **14** to place the box **15** in the closed configuration.

Referring now to FIG. 3 and corresponding cross-sectional side view FIG. 6, once the closure flap pairs **26** and **28** are folded to place the box **15** in the closed configuration, then box **10** can be secured in the closed configuration using any securing means **32** known in the art, such as tape, glue, staples, string, rope, wrapping paper, banding straps, and the like.

If sheet **20** has a heat-shrink attribute, then the sheet may be heated to a temperature sufficient to initiate the heat shrink response after the box is closed. This heating step may be accomplished, for example, by placing the packaging container **10** within a shrink tunnel or other oven, exposing the packaging container in total or the sheet itself to a stream of heated gas (e.g., air). For example, a tube may be used to pierce a side panel to gain access to, and supply a stream of heated gas to, the interior of the closed box (e.g., the storage compartment **14**).

As shown in FIG. 6, the major flaps **26** may be in substantially abutting contact upon closure of the flaps across the opening of the storage compartment **14**. Once the flaps **26** and **28** are closed, the article **22** may be retained within the storage compartment **14** and held securely in place by the sheet **20**. Article **22** may be spaced apart from the bottom **16** and side panels **18**, thus reducing the need for dunnage or other void-filling materials to protect the article during transport from impacts into the side panels or bottom.

In the embodiment shown in FIG. 8, a cushioning insert **36** is placed in the packaging container **10** between the article **22** and the flaps **26** and **28** to further protect the packaged article. Also, a cushioning insert may be placed between the article **22** and the first portion **50** of the sheet **20** (not shown). Useful cushioning inserts include any cushioning or dunnage materials known in the art, for example, paper or plastic dunnage, foam products, and air-inflated pillows and cushions.

Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing description. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.